Roll No. .....

24266

B. Tech. 5th Semester (CSE)

Examination – December, 2016

THEORY OF AUTOMATA COMPUTATION

Paper : CSE-305-F

Time : Three Hours] *[Maximum Marks : 100*

Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question No **1** is ***compulsory*** and Attempt at least ***one*** question from each of the four sections, all questions carry equal marks.

1. (a) Explain at least four differences between DFA and NFA. 4

(b) Explain Moore machine with the help of transition table and also draw transition diagram of the given transition table. 4

(c) Briefly explain any two types of normal forms in CFG. 4

(d) Define Turing machine mathematically and also explain its basic structure. 4

(e) What are UNIT productions in CFG and why they are uselss ? 4

SECTION – A

2. (a) $M = (\{q_1, q_2, q_3\}, (0, 1), \delta, q_1, \{q_3\})$ is a NFA,

where δ is given by :

$\delta(q_1, 0) = \{q_2, q_3\}$, $\delta(q_1, 1) = \{q_1\}$

$\delta(q_2, 0) = \{q_1, q_2\}$, $\delta(q_2, 1) = \{\phi\}$

$\delta(q_3, 0) = \{q_2\}$, $\delta(q_3, 1) = \{q_1, q_2\}$

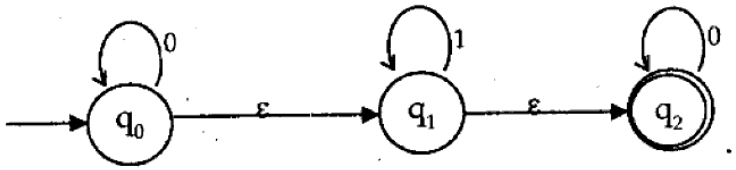
Construct an equivalent DFA. 12

(b) Construct a Melay machine equivalent to given Moore machine : 8

Present State	Next State		Output
	a = 0	a = 1	
→ q_0	q_1	q_2	1
q_1	q_3	q_2	0
q_2	q_2	q_1	1
q_3	q_0	q_3	1

3. (a) Remove the ε - transition from the given NFA. 10

(Note : By ε - closure method only)



(b) Take an example of Melay and Moore machine each and process any string of at least 4 alphabets from these machines and produce the resulting strings. 6

(c) State and prove Arden's theorem. 4

SECTION – B

4. (a) Convert the grammar in GNF.

$S \rightarrow AA \mid a$

$A \rightarrow SS \mid b$

(Note : by taking S as A_1 and A as A_2 method only) 12

(b) Discuss the ambiguity in CFG with the help of example. 8

5. (a) State and prove pumping lemma for regular languages. 10

(b) Find a reduced grammar equivalent to the grammar G whose productions are : 10

$S \rightarrow AB \mid CA$

$B \rightarrow Bc \mid AB$

$A \rightarrow a$

$C \rightarrow aB \mid b$

SECTION – C

6. (a) Design a PDA for the language

$L = \{ \omega \in (a, b)^* \mid \omega$ has equal number of a's and b's$\}$

Also show the acceptance of string abab with the help of designed PDA. 10

(b) Design a Turing Machine to recognise the language

$$L = \{a^n b^n \mid n \geq 1\}$$

Also perform the trace of the machine by taking a string aabb. 10

7. (a) Design a PDA for the language

$$L = \{ \omega \, \omega^r \mid \omega \in (a, b)^* \}$$

(i.e. without marker in the middle) 10

(b) Discuss the halting problem and PCP problem of turing machines. 10

SECTION – D

8. (a) What are Primitive recursive functions ? Show that the following function is primitive recursive : 10

$$r(x, y) = x - y$$

(b) Show that the CSL's are closed under the following operations : 10

(i) Union

(ii) Cocatenation

(iii) Intersection

(iv) Substitution

9. (a) Disuss in detail Chomsky hierarchy of grammars and also explain the relation between languages of classes under Chomsky classification with the help of diagram. 10

(b) Define the following : 10

(i) Recursive functions

(ii) Partial Recursive functions

(iii) Primitive Recursive functions
